

Electrically Controlled Drug Delivery from Graphene Oxide Nanocomposite Films

Cassandra L. Weaver^{1,2,3}, Jaclyn M. LaRosa¹, Xiliang Luo⁴, and Xinyan Tracy Cui^{1,2,3}*

¹Department of Bioengineering, ²Center for the Neural Basis of Cognition, ³McGowan Institute for Regenerative Medicine, University of Pittsburgh, Pittsburgh, PA 15260, United States, ⁴College of Chemistry and Molecular Engineering, Qingdao University of Science and Technology, Qingdao 266042, P.R., China.

FTIR Analysis: To verify that both GO nanosheets and DEX were incorporated into the PPy film, Fourier transform IR (FTIR) spectroscopy was performed on the pure GO nanosheets, and GO/PPy nanocomposite films with or without DEX as a co-dopant (Figure S1). The GO nanosheet spectrum exhibits characteristic peaks arising from oxygen-containing moieties (carboxylic C=O: 1736 cm^{-1} ; O-H deformation: 1406 cm^{-1} ; C-O-H stretch: 1221 cm^{-1} ; C-O-C stretching vibration: 1043 cm^{-1}).¹ The electrodeposited GO/PPy film spectrum contains a carboxylic carbonyl peak at 1705 cm^{-1} , attributable to GO, along with characteristic PPy peaks at 1472 cm^{-1} (C-N stretching vibration) and 964 cm^{-1} (N-H wag), confirming the successful incorporation of the GO nanosheets into the polymer.² The spectrum of the film synthesized in the presence of both GO and DEX molecules (GO/PPy-DEX) exhibits an additional carbonyl peak at 1657 cm^{-1} that arises from the carbonyl group conjugated to the double bond framework of the DEX molecule, along with a peak at 1146 cm^{-1} , assigned to the DEX phosphate group.³

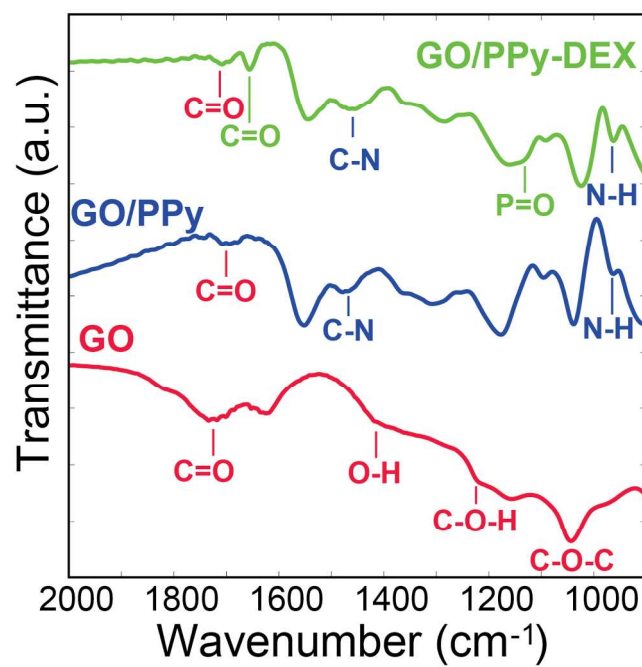


Figure S1: FTIR spectra of GO nanosheets, unloaded GO/PPy, and DEX-loaded GO/PPy.

On each spectrum, peaks labeled in red are contributed from GO, blue from PPy, and green from DEX.

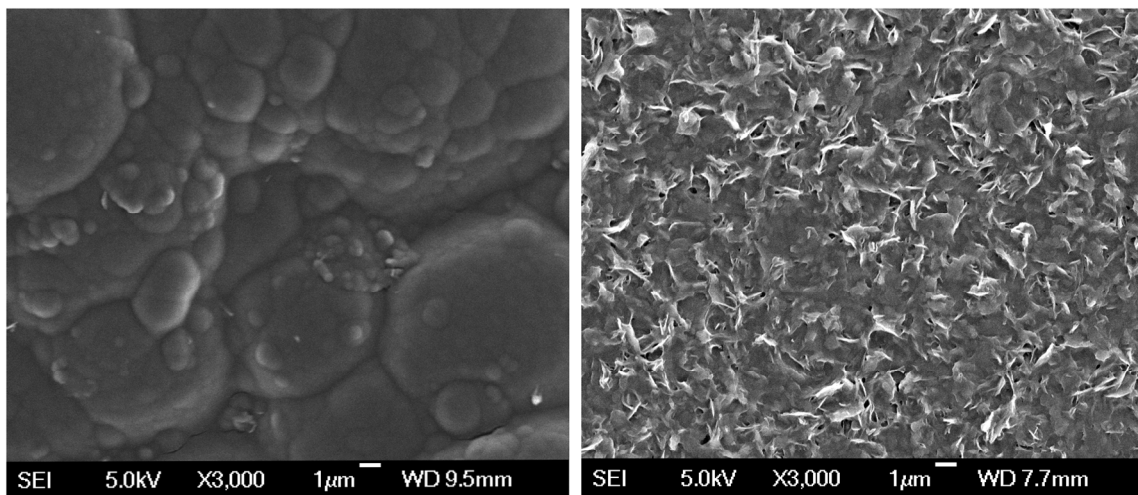


Figure S2: Surface morphology of DEX-loaded PPy films. Representative SEM images of a conventional DEX-loaded PPy film (left) and a DEX-loaded PPy/GO nanocomposite film (right). The conventional film exhibits a much smoother morphology than the nanocomposite that contains rough sheet-like protrusions at its surface.

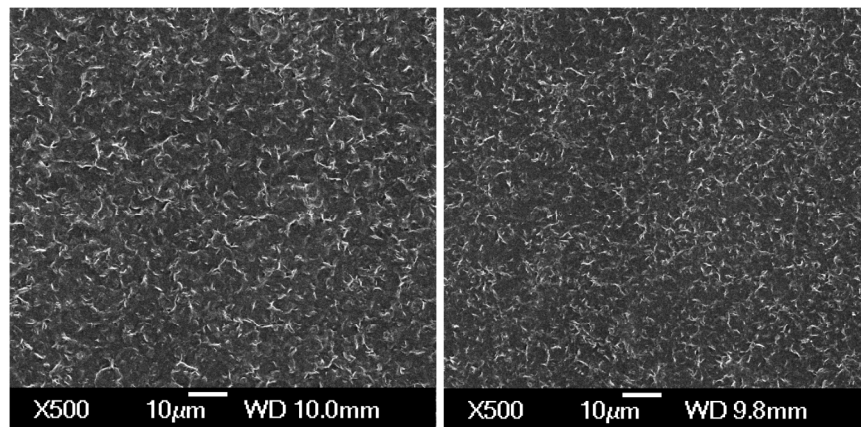


Figure S3: Stability of the DEX-loaded GO/PPy nanocomposite films. SEM images of the GO/PPy-DEX films before (left panel) and after (right panel) 1000 release stimulations (-0.5 V for 5 s followed by 0.5 V for 5 s). There is no visible cracking or delamination of the film post-stimulation, demonstrating the good stability of the film.

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